

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	The value of $\frac{e}{m}$ is smallest for :	(A) Proton	(B) Electron	(C) $\beta$ -particle	(D) Positron
2	At what frequency will an inductor of 1.0 H have a reactance of $500\Omega$ :	(A) 50 Hz	(B) 80 Hz	(C) 500 Hz	(D) 1000 Hz
3	The life time of an electron in an excited state is about $10^{-8}s$ . What is its uncertainty in energy during this time :	(A) $6.63 \times 10^{-34} J$	(B) $9.1 \times 10^{-31} J$	(C) $1.05 \times 10^{-26} J$	(D) $7.2 \times 10^{-15} J$
4	The binding energy per nucleon is maximum for :	(A) Hydrogen	(B) Nitrogen	(C) Uranium	(D) Iron
5	The electrostatic force between two charges is 42 N. If we place a dielectric of $\epsilon_r = 2.1$ between the charges then the force become equal to :	(A) 42 N	(B) 84 N	(C) 20 N	(D) 2 N
6	The Boolean expression of NAND gate is :	(A) $X = A.B$	(B) $X = \overline{A}$	(C) $X = \overline{A.B}$	(D) $X = A + B$
7	The value of charge on $1.0 \times 10^7$ electrons is :	(A) $1.6 \times 10^{-12} C$	(B) $1.6 \times 10^{+11} C$	(C) $1.6 \times 10^{-19} C$	(D) $1.6 \times 10^{+19} C$
8	Which factor does not affect the conductivity of PN-junction diode :	(A) Doping	(B) Temperature	(C) Voltage	(D) Pressure
9	By mass spectrograph we can find the value of mass by using formula :	(A) $m = \left( \frac{e^2 r^2}{2V} \right) B^2$	(B) $m = \left( \frac{e r^2}{2V} \right) B^2$	(C) $m = \left( \frac{eV}{2r^2} \right) B$	(D) $m = \left( \frac{eV^2}{2r} \right) B$
10	Maximum emf generated in a generator is :	(A) $\epsilon_o = \epsilon \sin \theta$	(B) $\epsilon = \epsilon_o \sin \theta$	(C) $\epsilon_o = N\omega AB \sin \theta$	(D) $\epsilon_o = N\omega AB$
11	It is required to suspend a proton of charge 'q' and mass 'm' in an electric field the strength of the field must be :	(A) $E = \frac{mg}{qv}$	(B) $E = \frac{mg}{q}$	(C) $E = \frac{q}{mg}$	(D) $E = \frac{qv}{B}$
12	The velocity of an oscillating charge as it moves to and fro along the wire is :	(A) Infinite	(B) Constant	(C) Changing	(D) Zero
13	Henry is equal to =	(A) $VS^{-1}$	(B) $VS^{-1}A$	(C) $V^{-1}S^{-1}A$	(D) $V^{-1}S^{-1}A^{-1}$
14	Good conductors have conductivities of the order of :	(A) $10^{-7}(\Omega m)^{-1}$	(B) $10^7(\Omega m)^{-1}$	(C) $10^2(\Omega m)^{-1}$	(D) $10^{-2}(\Omega m)^{-1}$
15	The unit of $\vec{E}$ is $NC^{-1}$ and that of $\vec{B}$ is $NA^{-1}m^{-1}$ then the unit of $\frac{E}{B}$ is :	(A) $ms^{-2}$	(B) $ms$	(C) $m^{-1}s^{-1}$	(D) $ms^{-1}$
16	The numerical value of Stefan's constant is :	(A) $5.67 \times 10^{-8}$	(B) $2.9 \times 10^{-3}$	(C) $6.63 \times 10^{-34}$	(D) $1.6 \times 10^{-19}$
17	The numerical value of Rydberg's constant is :	(A) $1.0974 \times 10^7$	(B) $1.0974 \times 10^{-7}$	(C) $1.0974 \times 10^{14}$	(D) $1.0974 \times 10^{-14}$

SECTION – I

2. Write short answers to any EIGHT (8) questions :

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- (i) What is electric intensity? What is its SI unit?
- (ii) Show that  $\frac{1 \text{ volt}}{1 \text{ meter}} = \frac{1 \text{ Newton}}{1 \text{ Coulomb}}$
- (iii) Describe the force or forces on a positive point charge when placed between parallel plates with similar and equal charges.
- (iv) Do electrons tend to go to region of high potential or of low potential?
- (v) Describe the change in the magnetic field inside a solenoid carrying a steady current I, if the length of the solenoid is doubled but the number of turns remains the same.
- (vi) What is CRO? What is the function of grid in CRO?
- (vii) Define ammeter. How can we increase the range of an ammeter?
- (viii) Suppose that a charge  $q$  is moving in a uniform magnetic field with a velocity  $V$ . Why is there no work done by the magnetic force that acts on the charge  $q$ ?
- (ix) State Faraday's law of electromagnetic induction and also write expression for it.
- (x) Define mutual inductance of the coils and also define its unit henry.
- (xi) Does the induced emf in a circuit depend on the resistance of the circuit? Does the induced current depend on the resistance of the circuit?
- (xii) In a transformer, there is no transfer of charge from the primary to secondary. How is, then the power transferred?

3. Write short answers to any EIGHT (8) questions :

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- (i) Define temperature coefficient of resistance and write its formula.
- (ii) A potential difference is applied across the ends of a copper wire. What is the effect on the drift velocity of free electrons by decreasing the length and the temperature of the wire?
- (iii) Is the filament resistance lower or higher in a 500 w, 220 v light bulb than in a 100 w, 220 v?
- (iv) What is impedance? Write its formula.
- (v) A sinusoidal current has rms value of 10A. What is the maximum or peak value?
- (vi) What is meant by A.M. and F.M.?
- (vii) Differentiate between ductile and brittle substances.
- (viii) Define stress and strain. What are their SI units?
- (ix) What is meant by hysteresis loss?
- (x) What is depletion region?
- (xi) How does the motion of an electron in a n-type substance differ from the motion of holes in a p-type substance?
- (xii) What is the principle of virtual ground?

4. Write short answers to any SIX (6) questions :

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- (i) Define Compton effect. At what angle Compton shift becomes equal to the Compton wave length?
- (ii) As a solid is heated and begins to glow, why does it first appear red?
- (iii) What happens to radiation energy from a blackbody if its temperature is doubled?

(Turn Over)



(2)

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4. (iv) Define excitation energy and ionization energy.
- (v) How can spectrum of hydrogen contain so many lines when hydrogen contains one electron? Explain.
- (vi) Can X-rays be reflected, refracted and polarized just like any other waves? Explain.
- (vii) Write down two advantages of solid state detector.
- (viii) Why are heavy nuclei unstable?
- (ix) A particle which produces more ionization is less penetrating. Why?

### SECTION – II

**Note :** Attempt any THREE questions.

5. (a) What is Gauss's law? Applying Gauss's law find the electric intensity between two oppositely charged parallel plates. 5
- (b) A rectangular bar of iron is 2.0 cm by 2.0 cm in cross-section and 40 cm long. Calculate the resistance if the resistivity of iron is  $11 \times 10^{-8} \Omega m$ . 3
6. (a) Derive an expression for torque acting on current carrying coil placed in uniform magnetic field. 5
- (b) A circular coil has 15 turns of radius 2 cm each. The plane of the coil lies at  $40^\circ$  to a uniform magnetic field of 0.2 T. If the field is increased by 0.5 T in 0.2 s, find the magnitude of induced emf? 3
7. (a) Define comparator. Describe how it is used as a night switch. 1,1,3
- (b) A circuit has an inductance of  $\frac{1}{\pi} H$  and resistance of  $2000 \Omega$ . A 50 Hz A.C is supplied to it. Calculate the reactance and impedance offered by the circuit. 3
8. (a) Describe the formation of energy bands in solids. Explain the difference amongst electrical behaviour of conductors, insulators and semiconductors in terms of energy band theory. 5
- (b) An electron is to be confined to a box of the size of the nucleus ( $1.0 \times 10^{-14} m$ ). What would the speed of the electron be if it were so confined? 3
9. (a) What are postulates of Bohr's model of the hydrogen atom? Show that energy of hydrogen atom is quantized. 5
- (b) How much energy is absorbed by a man of mass 80 kg who receives a lethal whole body equivalent dose of 400 rem in the form of low energy neutrons for which RBE factor is 10? 3

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